WHAT IS CLAIMED IS:

Sub A1

1. An X-ray exposure apparatus comprising an X-ray mirror containing a material having an absorption edge only in at least either one of a wavelength region of less than 0.45 nm and a wavelength region exceeding 0.7 nm as to X-rays.

2. The X-ray exposure apparatus according to claim 1, wherein said X-rays are included in radiation outgoing from a synchrotron radiation source.

3. The X-ray exposure apparatus according to claim 1, wherein said X-ray mirror includes an X-ray mirror for cutting shorter wavelengths absorbing at least 90 % of X-rays of a wavelength region of less than 0.3 nm.

4. The X-ray exposure apparatus according to claim 1, wherein said X-ray mirror contains a single type of mirror material selected from a group consisting of beryllium, titanium, silver, ruthenium, rhodium and palladium, nitrides, carbides and borides of these, diamond, diamond-like carbon and boron nitride.

5. The X-ray exposure apparatus according to claim 1, wherein said X-ray mirror has a function of converging X-rays.

6. The X-ray exposure apparatus according to claim 1, wherein said X-ray mirror has a function of magnifying the area of a region capable of being simultaneously irradiated with X-rays outgoing from said X-ray mirror.

7. The X-ray exposure apparatus according to claim 1, further comprising an X-ray converging mirror.

8. The X-ray exposure apparatus according to claim 1, further

comprising a magnifying mirror having a function of magnifying the area of a region capable of being simultaneously irradiated with X-rays outgoing from said X-ray mirror.

9. The X-ray exposure apparatus according to claim 1, wherein a surface of said X-ray mirror upon which X-rays are incident is mechanically polished.

10. The X-ray exposure according to claim 1, wherein a surface of said X-ray mirror upon which X-rays are incident is chemically polished.

11. The X-ray exposure apparatus according to claim 1 further comprising an X-ray mask, wherein said X-ray mask includes a membrane and an X-ray absorber formed on said membrane, and

said membrane contains a single species selected from a group consisting of diamond, diamond-like carbon, boron nitride and beryllium.

12. The X-ray exposure apparatus according to claim 1 further comprising an X-ray mask, wherein said X-ray mask includes a membrane and an X-ray absorber formed on said membrane,

said membrane contains a material having an absorption edge only in at least either one of a wavelength region of less than 0.45 nm and a wavelength region exceeding 0.7 nm as to X-rays, and

said X-ray absorber contains a material having an absorption edge in a wavelength region of at least 0.6 nm and less than 0.85 nm.

13. The X-ray exposure apparatus according to claim 1, comprising a plurality of said X-ray mirrors.

14. The X-ray exposure apparatus according to claim 1, wherein the outgoing direction of X-rays outgoing from said X-ray mirror finally reached by X-rays is substantially identical to the incidence direction of X-rays incident upon said X-ray mirror initially reached by X-rays.

15. The X-ray exposure apparatus according to claim 1, wherein the outgoing optical axis of X-rays outgoing from said X-ray mirror finally reached by X-rays is substantially identical to the incidence optical axis of X-rays incident upon said X-ray mirror initially reached by X-rays.

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16. An X-ray mirror having an absorption edge only in at least either one of a wavelength region of less than 0.45 nm and a wavelength region exceeding 0.7 nm as to X-rays.

17. The X-ray mirror according to claim 16, reflecting X-rays included in radiation outgoing from a synchrotron radiation source.

18. The X-ray mirror according to claim 16, absorbing at least 90 % of X-rays in a wavelength region of less than 0.3 nm and cutting shorter wavelengths.

19. The X-ray mirror according to claim 16, wherein said X-ray mirror contains a single type of mirror material selected from a group consisting of beryllium, titanium, silver, ruthenium, rhodium and palladium, nitrides, carbides and borides of these, diamond, diamond-like carbon and boron nitride.

20. The X-ray mirror according to claim 16, having a function of converging X-rays.

21. The X-ray mirror according to claim 16, having a function of magnifying the area of a region capable of being simultaneously irradiated with X-rays.

22. The X-ray mirror according to claim 16, wherein a surface upon which X-rays are incident is mechanically polished.

23. The X-ray mirror according to claim 16, wherein a surface upon which X-rays are incident is chemically polished.

24. An X-ray exposure method comprising:

an X-ray incidence step of making X-rays incident upon an X-ray mirror containing a material having an absorption edge only in at least either one of a wavelength region of less than 0.45 nm and a wavelength region exceeding 0.7 nm as to X-rays; and

an exposure step of performing exposure with X-rays outgoing from said X-ray mirror.

25. The X-ray exposure method according to claim 24, further comprising an X-ray outgoing step of making said X-rays outgo from a synchrotron radiation source.

26. The X-ray exposure method according to claim 24, wherein said X-ray mirror includes an X-ray mirror for cutting shorter wavelengths, absorbing at least 90 % of X-rays in a wavelength region of less than 0.3 nm.

27. The X-ray exposure method according to claim 24, wherein said X-ray mirror contains a single type of mirror material selected from a group consisting of beryllium, titanium, silver, ruthenium, rhodium and palladium, nitrides, carbides and borides of these, diamond, diamond-like carbon and boron nitride.

28. The X-ray exposure method according to claim 24, wherein said X-ray incidence step includes a step of converging X-rays with said X-ray mirror.

29. The X-ray exposure method according to claim 24, wherein said X-ray incidence step includes a step of magnifying the area of a region capable of being simultaneously irradiated with X-rays outgoing from said X-rays with said X-ray mirror.

30. The X-ray exposure method according to claim 24, wherein said X-ray incidence step includes a step of further converging X-rays with a converging mirror.

31. The X-ray incidence method according to claim 24, wherein said X-ray incidence step includes a step of magnifying the area of a region capable of being simultaneously irradiated with X-rays outgoing from said X-ray mirror with a magnifying mirror.

32. The X-ray exposure method according to claim 24, employing said X-ray mirror whose surface upon which X-rays are incident is mechanically polished in said X-ray incidence step.

33. The X-ray exposure method according to claim 24, employing said X-ray mirror whose surface upon which X-rays are incident is chemically polished in said X-ray incidence step.

34. The X-ray exposure method according to claim 24 employing an X-ray mask, wherein said X-ray mask includes a membrane and an X-ray absorber formed on said membrane, and

said membrane contains a single species selected from a group consisting of diamond, diamond-like carbon, boron nitride and beryllium.

35. The X-ray exposure method according to claim 24 employing an X-ray mask, wherein said X-ray mask includes a membrane and an X-ray absorber formed on said membrane,

said membrane contains a material having an absorption edge only in at least either one of a wavelength region of less than 0.45 nm and a wavelength region exceeding 0.7 nm as to X-rays, and

said X-ray absorber contains a material having an absorption edge in a wavelength region of at least 0.6 nm and less than 0.85 nm.

36. The X-ray exposure method according to claim 24, employing a plurality of said X-ray mirrors in said X-ray incidence step.

37. The X-ray exposure method according to claim 24, wherein the outgoing direction of X-rays outgoing from said X-ray mirror finally reached by X-rays is substantially identical to the incidence direction of X-rays incident upon said X-ray mirror initially reached by X-rays in said X-ray incidence step.

38. The X-ray exposure method according to claim 24 , wherein the outgoing optical axis of X-rays outgoing from said X-ray mirror finally reached by X-rays is substantially identical to the incidence optical axis of X-rays incident upon said X-ray mirror initially reached by X-rays in said X-ray incidence step.

39. A semiconductor device manufactured with the X-ray exposure method according to claim 24.

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40. A synchrotron radiation apparatus comprising a synchrotron radiation source and an X-ray mirror group including a plurality of X-ray mirrors upon which radiation outgoing from said synchrotron radiation source is incident, wherein

said X-ray mirrors contain a material having an absorption edge only in at least either one of a wavelength region of less than 0.45 nm and a wavelength region exceeding 0.7 nm as to X-rays, and

the outgoing direction of said radiation outgoing from said synchrotron radiation source and the outgoing direction of reflected light outgoing from said X-ray mirror group are substantially identical.

41. The synchrotron radiation apparatus according to claim 40, wherein the outgoing optical axis of said radiation outgoing from said synchrotron radiation source and the outgoing optical axis of reflected light outgoing from said X-ray mirror group are substantially identical.

42. A synchrotron radiation method employing a synchrotron radiation apparatus comprising a synchrotron radiation source and an X-ray mirror group including a plurality of X-ray mirrors upon which radiation outgoing from said synchrotron radiation source is incident, said synchrotron radiation method comprising:

a radiation incidence step of making radiation outgoing from the synchrotron radiation source incident upon an X-ray mirror containing a material having an absorption edge only in at least either one of a wavelength region of less than 0.45 nm and a wavelength region exceeding 0.7 nm as to X-rays, and

a reflected light emitting step of emitting reflected light from said X-ray mirror group in a direction substantially identical to the outgoing direction of the radiation outgoing from said synchrotron radiation source.

43. The synchrotron radiation method according to claim 42, wherein the outgoing optical axis of the radiation outgoing from said synchrotron radiation source and the outgoing optical axis of the reflected light outgoing from said X-ray mirror group are substantially identical.

44. An X-ray mask comprising a membrane and an X-ray absorber formed on said membrane, wherein

said membrane contains a material having an absorption edge only in at least either one of a wavelength region of less than 0.45 nm and a wavelength region exceeding 0.7 nm as to X-rays, and

said X-ray absorber contains a material having an absorption edge in a wavelength region of at least 0.6 nm and less than 0.85 nm.

45. An X-ray exposure apparatus including the X-ray mask according to claim 44.

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